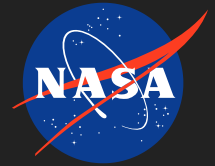


Operational Evaluation of a Photic Countermeasure to Improve Alertness, Performance, and Mood During Night-Shift Work on the 105-Day Study (105-Day Russian Chamber Study)

Completed Technology Project (2009 - 2010)



Project Introduction

The 105-day isolation study was conducted at the Institute for Biomedical Problems (IBMP) from 31 Mar 09 to 14 Jul 09. Six crewmembers lived and worked in an isolation facility and participated in our study validating the efficacy and operational feasibility of a photic countermeasure to improve alertness and performance during night shift work occurring during a simulated expedition mission. Eighteen mission controllers who worked 24-hour extended duration shifts also participated in the study. Throughout the 105-day experiment, a variety of measurements were obtained to assess sleep, performance, alignment of the circadian system, and melatonin levels. All data were collected and analyzed and a manuscript is in preparation.

Anticipated Benefits

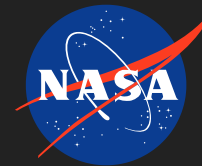
Extended duration work schedules and nighttime operations are associated with impaired performance, reduced alertness and mood, and increased sleepiness and risk of accidents. Appropriately scheduled light/dark exposure is a powerful means of resetting the human circadian pacemaker. Bright light has been used in various clinical settings to induce physiologic adaptation in individuals suffering from circadian rhythm disorders (e.g., night shift workers, people with Advanced and Delayed Sleep Phase Syndromes). Properly timed exposure to bright light can produce rapid physiologic adaptation of the circadian pacemaker to a single week of night work and facilitate rapid entrainment to a rotating work schedule, as well as enhance the alertness of night workers during their work shifts. Advanced and Delayed Sleep Phase Syndromes (ASPS and DSPS, respectively) are characterized by a marked difficulty in maintaining appropriate timing of sleep during the desired hours, and there is evidence suggesting that circadian misalignment may underlie the pathophysiology of this condition. We and others have reported data from clinical studies that suggest evening exposure to bright light or early morning exposure to bright light are successful in the treatment of ASPS or DSPS, respectively. The current study was designed to evaluate the effectiveness of shorter wavelength light exposure over intermediate and longer wavelength light as a countermeasure for circadian misalignment. The findings highlight the need for further development of effective and energy-efficient methods for treatment of circadian rhythm disorders. Optimizing the wavelength of light holds the potential for producing shorter, more efficient light treatment regimens. Shorter treatment regimens would not only increase compliance in clinical populations, but would make light treatment more practical in industrial/work settings. This lighting countermeasure could be beneficial for those on Earth who work extended duration overnight shifts or other unusual schedules and may negate the effects of fatigue on work performance.



Operational Evaluation of a Photic Countermeasure to Improve Alertness, Performance, and Mood During Night-Shift Work on the 105-Day Study (105-Day Russian Chamber Study)

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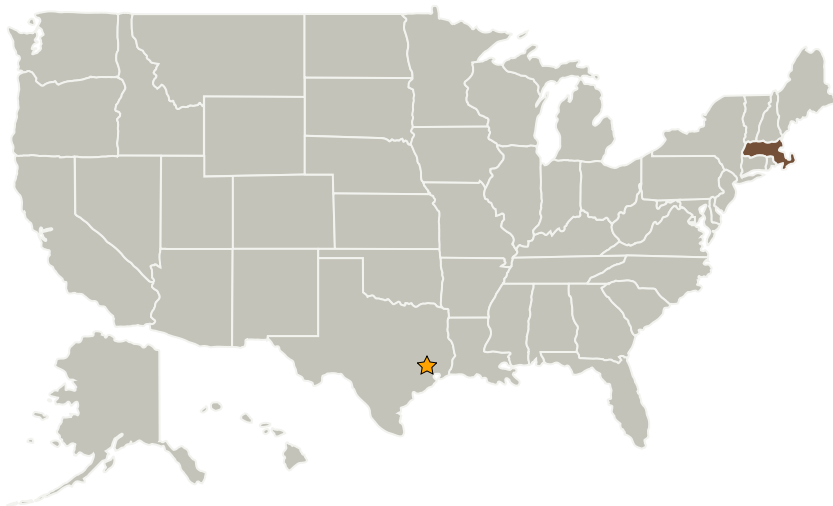
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Brigham And Women's Hospital, Inc.	Supporting Organization	Industry	Boston, Massachusetts
University of Colorado Boulder	Supporting Organization	Academia	Boulder, Colorado

Primary U.S. Work Locations

Massachusetts

Project Transitions



February 2009: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Operations Mission Directorate (SOMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Human Spaceflight Capabilities

Project Management

Program Director:

David K Baumann

Principal Investigator:

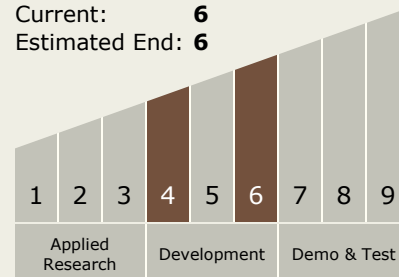
Charles A Czeisler

Co-Investigators:

Kenneth W Wright
Laura K Barger

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Operational Evaluation of a Photic Countermeasure to Improve Alertness, Performance, and Mood During Night-Shift Work on the 105-Day Study (105-Day Russian Chamber Study)

Completed Technology Project (2009 - 2010)



✓ August 2010: Closed out

Closeout Summary: The 105-day isolation study was conducted at the Institute for Biomedical Problems (IBMP) from 31 Mar 09 to 14 Jul 09. Six crewmembers lived and worked in an isolation facility and participated in our study validating the efficacy and operational feasibility of a photic countermeasure to improve alertness and performance during night shift work occurring during a simulated expedition mission. Eighteen mission controllers who worked 24-hour extended duration shifts also participated in the study. Throughout the 105-day experiment, a variety of measurements were obtained to assess sleep, performance, alignment of the circadian system, and melatonin levels. All data were collected and analyzed and a manuscript is in preparation.

Stories

Articles in Peer-reviewed Journals
(<https://techport.nasa.gov/file/8620>)

Articles in Peer-reviewed Journals
(<https://techport.nasa.gov/file/8624>)

Articles in Peer-reviewed Journals
(<https://techport.nasa.gov/file/8621>)

Articles in Peer-reviewed Journals
(<https://techport.nasa.gov/file/8622>)

Articles in Peer-reviewed Journals
(<https://techport.nasa.gov/file/8623>)

Awards
(<https://techport.nasa.gov/file/8613>)

Awards
(<https://techport.nasa.gov/file/8609>)

Awards
(<https://techport.nasa.gov/file/8611>)

Awards
(<https://techport.nasa.gov/file/8614>)

Awards
(<https://techport.nasa.gov/file/8610>)

Awards
(<https://techport.nasa.gov/file/8612>)

Awards
(<https://techport.nasa.gov/file/8608>)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.3 Human Health and Performance
 - └ TX06.3.3 Behavioral Health and Performance

Target Destinations

The Moon, Mars

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Awards

(<https://techport.nasa.gov/file/8615>)

Books/Book Chapters

(<https://techport.nasa.gov/file/8617>)

Books/Book Chapters

(<https://techport.nasa.gov/file/8616>)

Books/Book Chapters

(<https://techport.nasa.gov/file/8618>)

Journal/Magazine covers

(<https://techport.nasa.gov/file/8619>)

Project Website:

<https://taskbook.nasaprs.com>